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B8T THSB T13A

(56) Documents Cited  
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US 4410097 A

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(54) Abstract Title  
Closure with trapezoidal or triangular lug

(57) A closure 29 has a top wall and an annular side wall 22 with at least one inwardly projecting lug 27 which may be trapezoidal or triangular (127, fig 13). The closure may also have an internal thread 24 on the side wall. The lug may project from the side wall at an acute angle ( $\alpha$ , fig 3) and may have a downwardly tapering cross-section. The closure is intended for use on a container neck 13 with a projecting locking lug 16, removal of the closure being effected by squeezing so that the projecting lug 27 is deflected away from the locking lug 16. The shape of the projecting lug allows the closure to be more easily removed from a moulding tool after moulding.

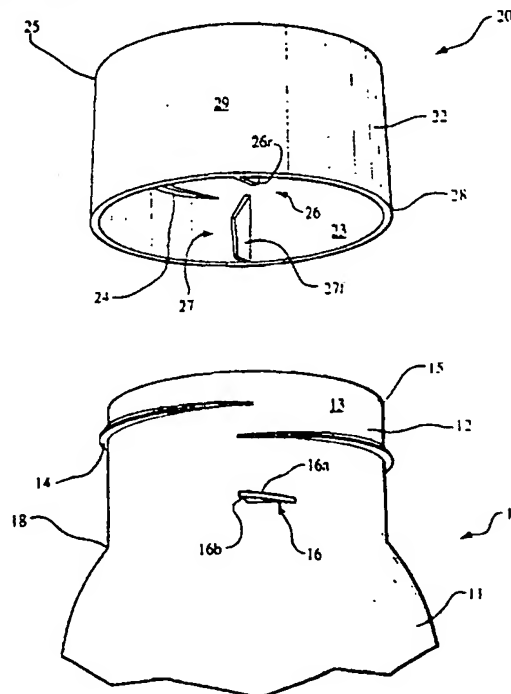


FIG. 1

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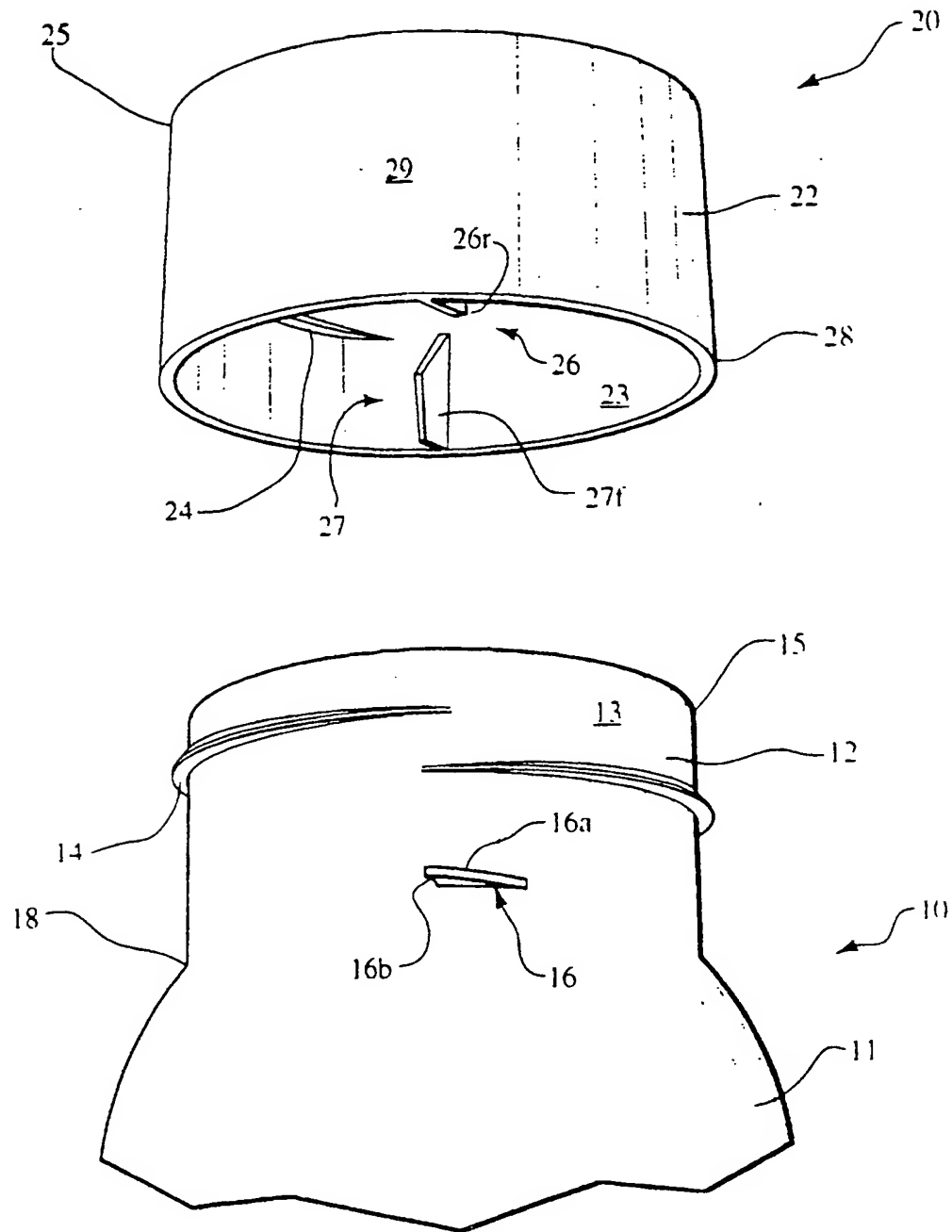
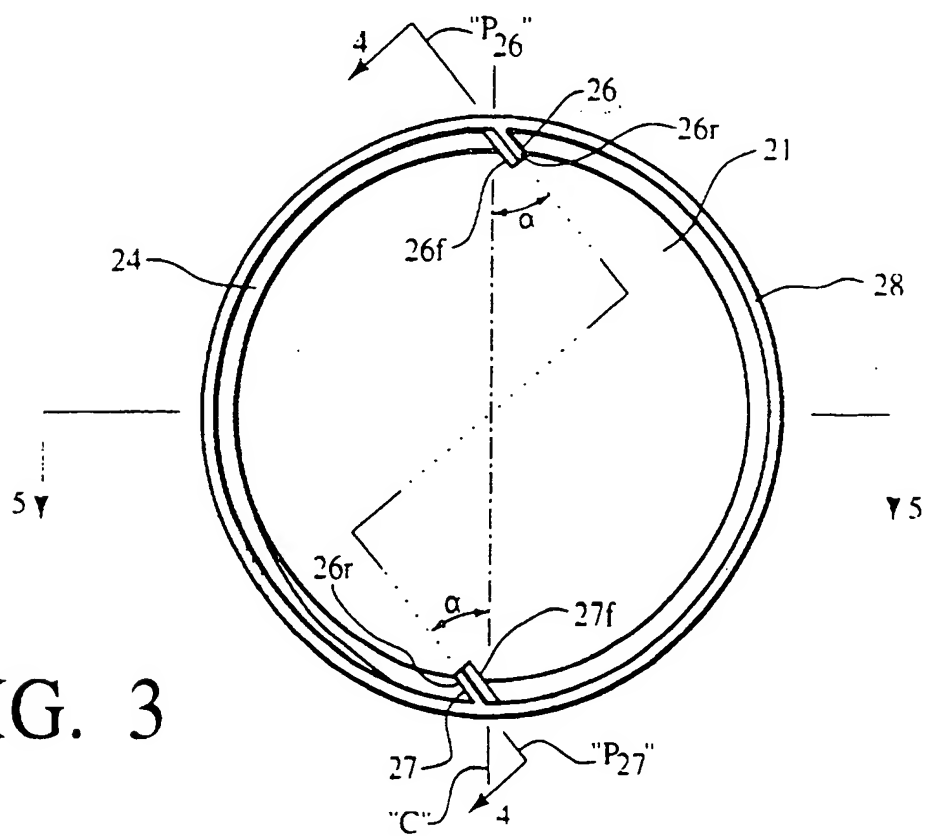
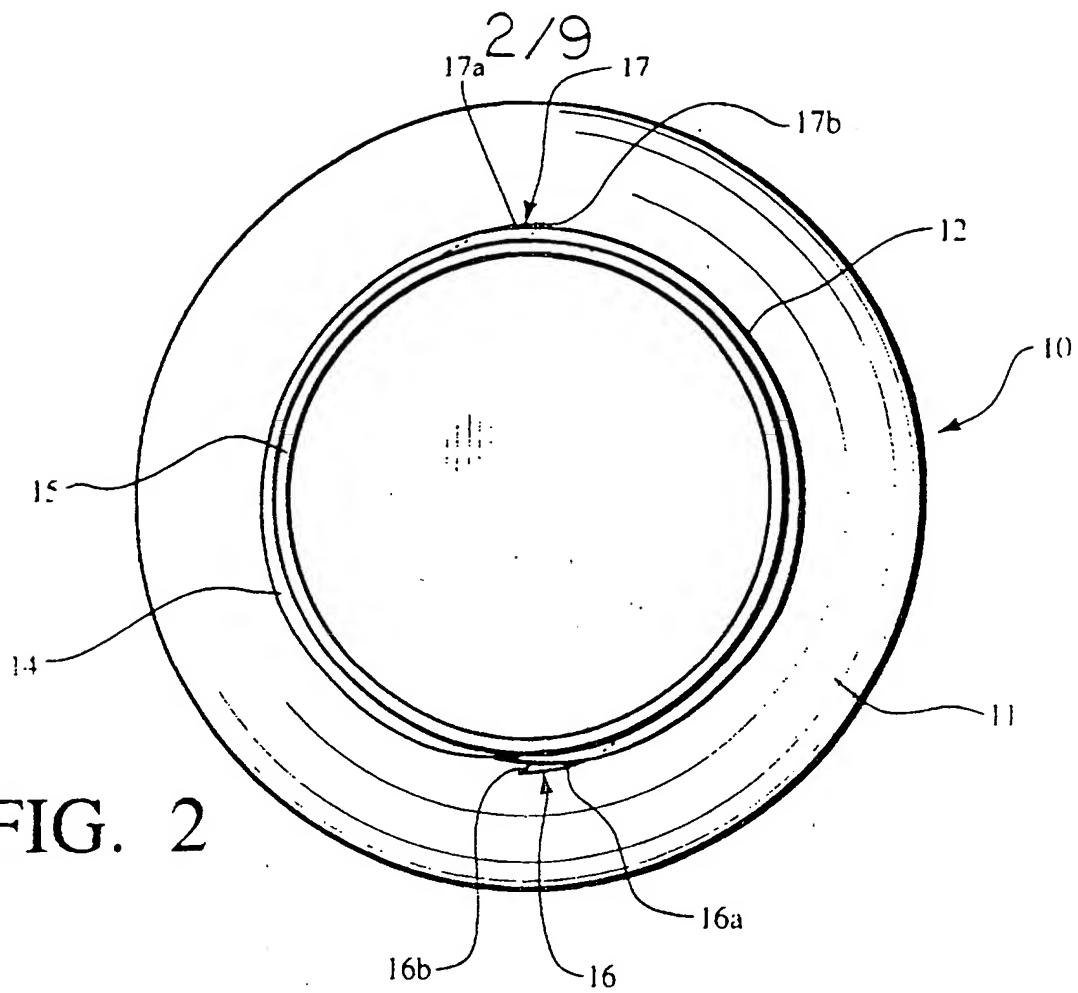


FIG. 1



A cross-sectional view of a semiconductor device. It shows a substrate 21 with a thin layer 22 on top. Below layer 22 is a layer 23, which contains a central structure 26. Structure 26 has a top width  $W1$  and a bottom width  $W2$ . A layer 24 is shown on the right side of structure 26. The device is shown in a perspective view with a dashed line indicating a cross-section.

FIG. 4a

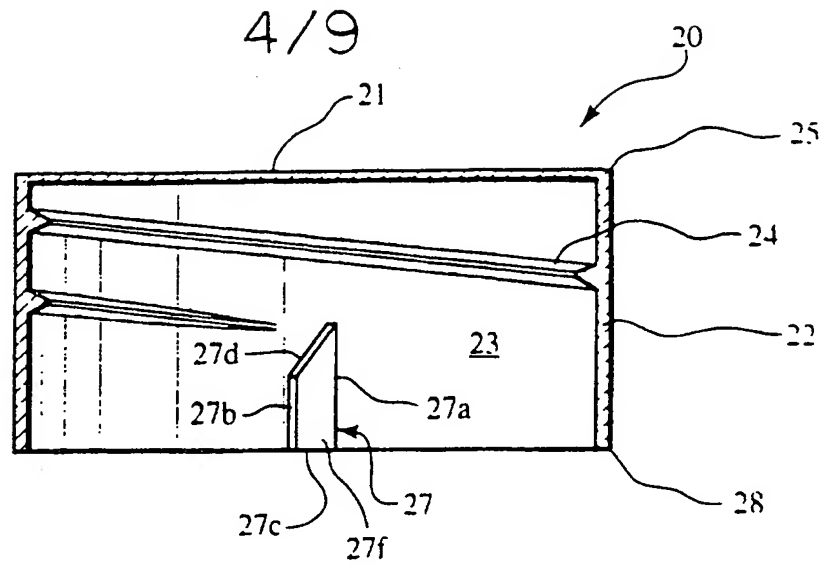


FIG. 5

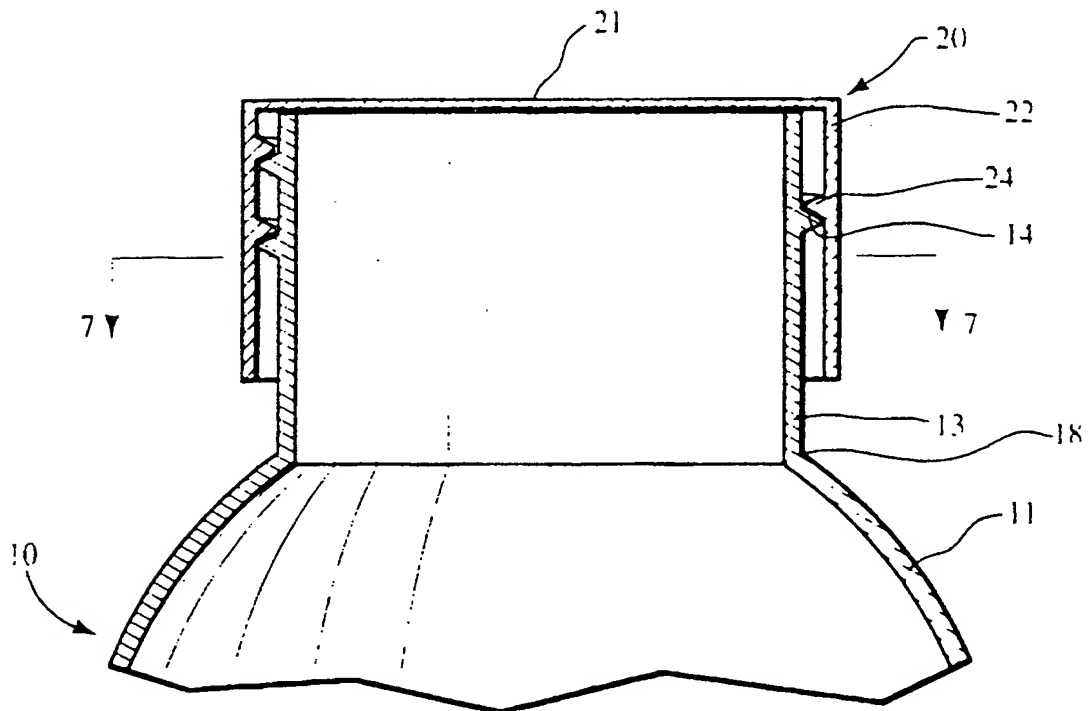


FIG. 6

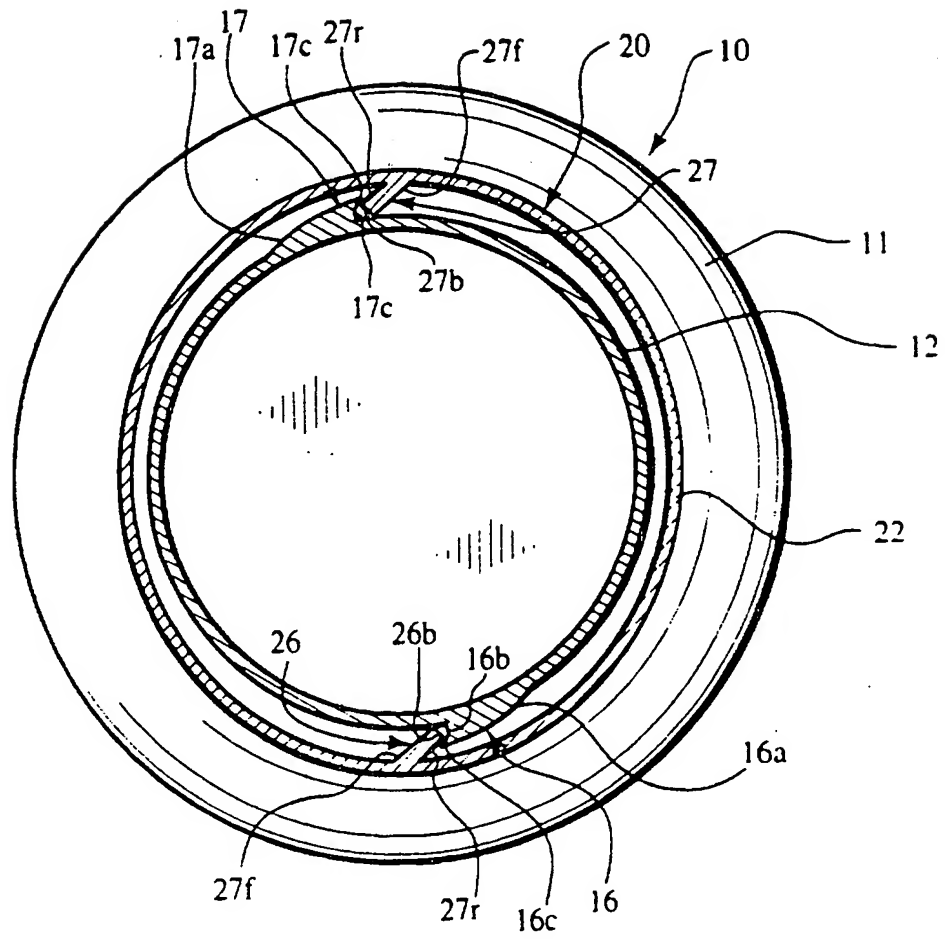


FIG. 7

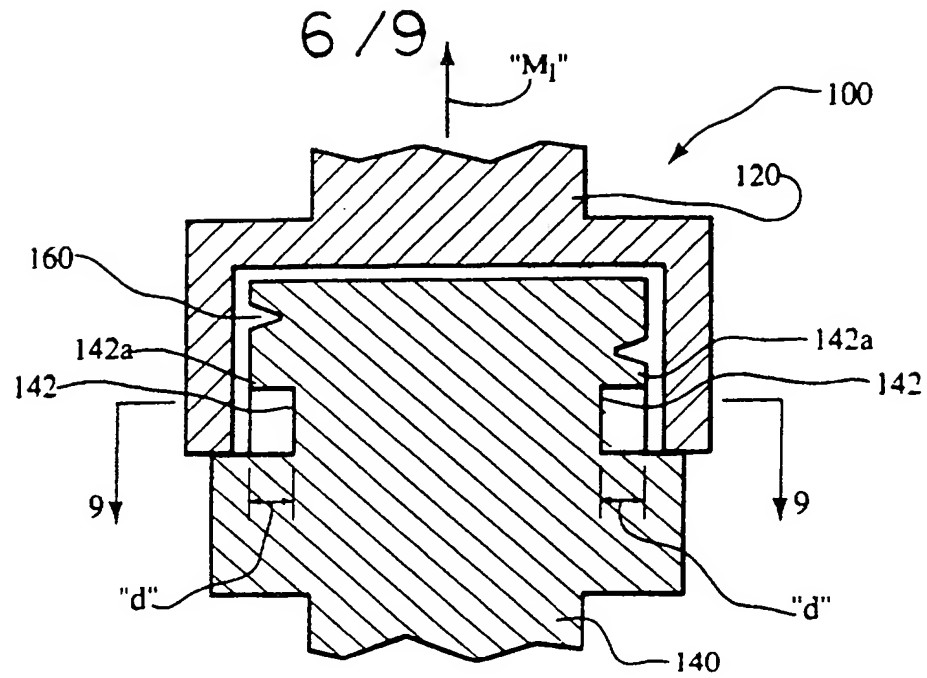


FIG. 8  
(PRIOR ART)

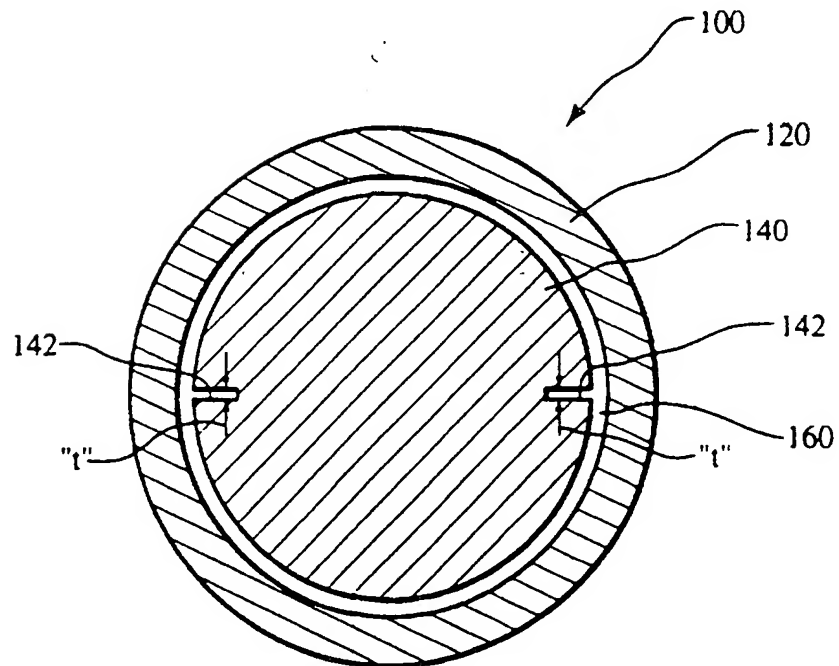


FIG. 9  
(PRIOR ART)

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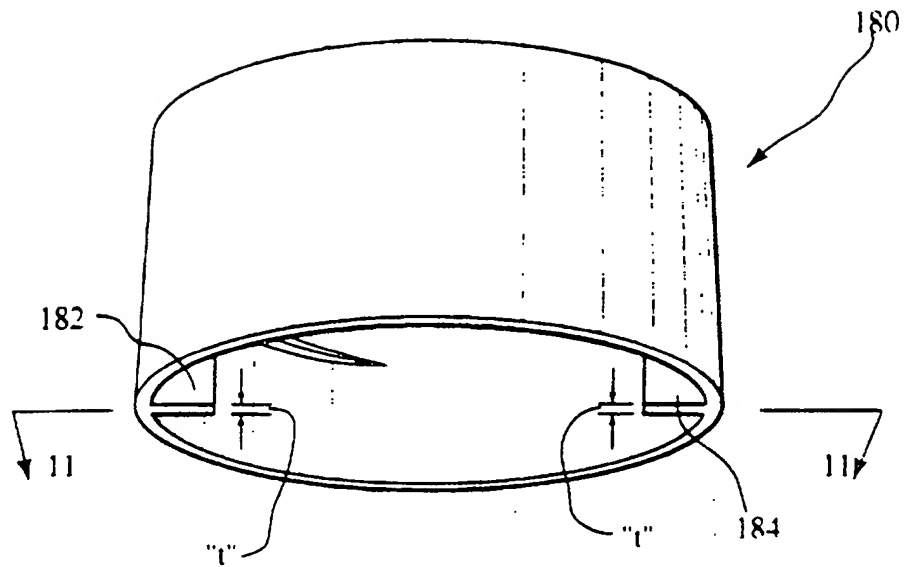


FIG. 10  
(PRIOR ART)

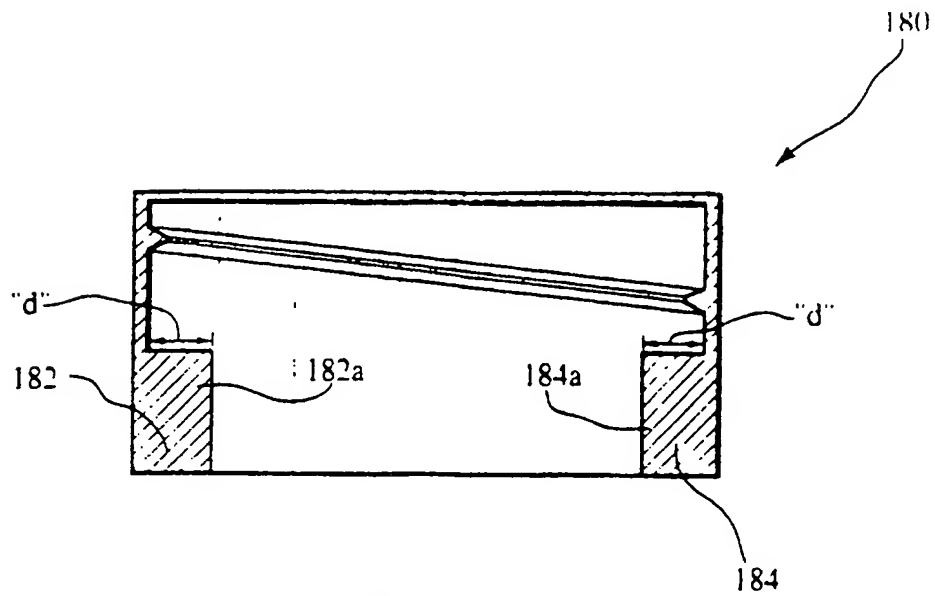
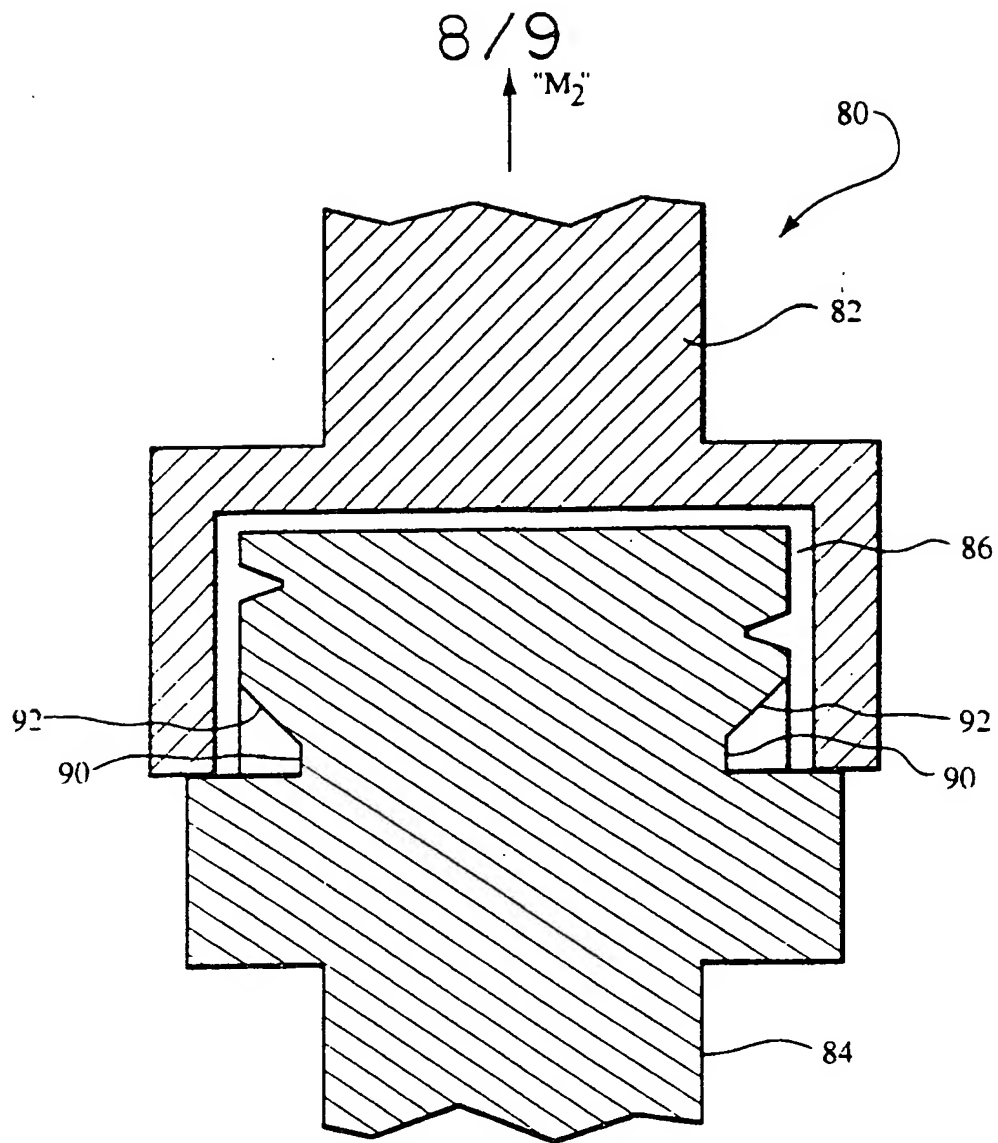


FIG. 11  
(PRIOR ART)





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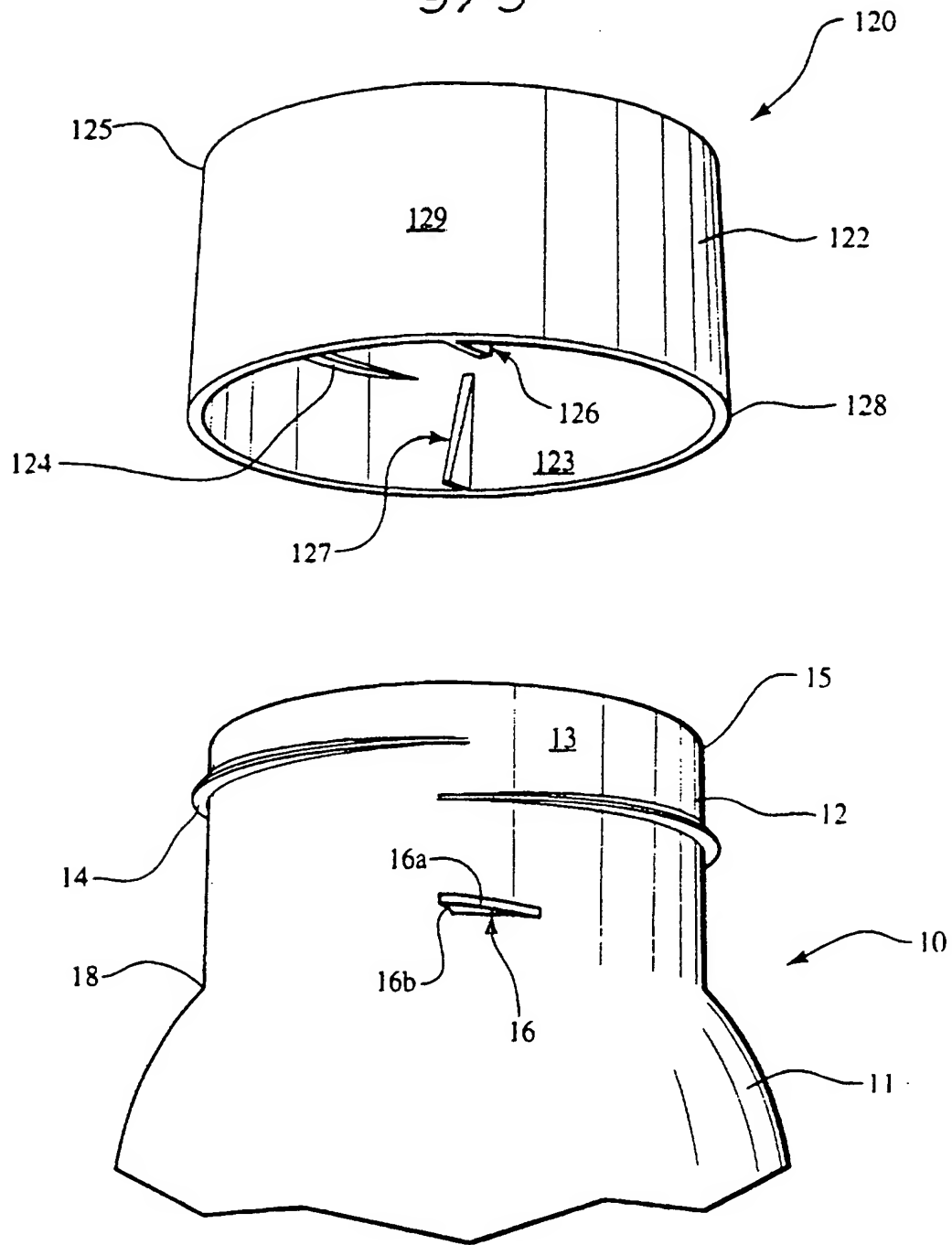


FIG. 13

## CLOSURE HAVING BACK-ANGLED LUGS

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The present invention relates to safety closures for use on containers. More particularly, the present invention relates to a safety closure for use on a container wherein the safety closure is provided with means to prevent removal of the safety closure from the container.

15 The use of cooperating locking lugs on safety closures and containers to prevent individuals of tender age from gaining access to the contents of the container is relatively well-known in the prior art. Typically, a safety closure is provided including a flexible annular skirt having an inner annular surface thereof and a pair of opposed locking lugs projecting inwardly therefrom. A container is also provided with a container neck portion having on an exterior surface thereof a pair of opposed, outwardly-projecting locking lugs. The safety closure of this type is threadingly engageable on the container neck portion until the closure locking lugs pass over and beyond their respective cooperating container locking lugs, thereby causing interference therebetween and preventing removal rotation of the safety closure relative to the container neck. Removal of the safety closure from the container neck requires an individual to first overcome the

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interference between the cooperating locking lugs and to then concurrently apply sufficient removal rotation to the safety closure relative to the container. It is therefore desirable to provide a safety closure for use on a container wherein the safety closure is provided with locking lugs to prevent removal of the safety closure from the container.

For example, U.S. Patent No. 3,941,268 to Owens, et al., teaches a safety closure and a container having cooperating locking lugs to prevent removal of the safety closure from the container. More particularly, the locking lugs of the safety closure according to the Owens '268 patent project inwardly from an inner surface thereof along a plane substantially perpendicular thereto. Even further, the container locking lugs project outwardly from an outer surface thereof along a plane substantially perpendicular thereto. As such, the cooperating locking lugs interfere along a plane substantially perpendicular to either the safety closure inner surface or the container outer surface. Accordingly, very little flexing thereof is required before the cooperating locking lugs "skip" over one another. It is thus desirable to provide a safety closure for use on a container wherein the safety closure and the container are provided with cooperating locking lugs to prevent removal of the safety closure from the container and wherein the respective locking lugs are angled sufficiently relative to one another to enhance the interference therebetween.

For example, U.S. Patent No. 4,213,534 to Montgomery teaches a child-resistant closure for use on a container

wherein the closure is provided with internal back-angled lugs for engaging cooperating back-angled lugs provided on the container. However, it is furthermore desirable to provide a safety closure for use on a container wherein the safety closure is provided with back-angled locking lugs respectively having a height which is less than the height of the closure.

For example, U.S. Patent No. 2,423,582 to Coleman teaches a bottle cap for use on a container wherein the bottle cap includes internal back-angled tongues for engaging cooperating sloping lugs provided on the container and wherein the back-angled tongues of the bottle cap do not extend the full longitudinal height of the bottle cap. However, it is furthermore desirable to provide a safety closure for use on a container wherein the safety closure is provided with locking lugs having a shape which permits efficient molding thereof.

It is an object of the present invention to provide a safety closure for use on a container wherein the safety closure is provided with locking lugs to prevent removal of the safety closure from the container.

It is another object of the present invention to provide a safety closure for use on a container wherein the safety closure and the container are provided with cooperating locking lugs to prevent removal of the safety closure from the container and wherein the respective locking lugs are angled sufficiently relative to one another to enhance the interference therebetween.

It is yet another object of the present invention to provide a safety closure for use on a container wherein the safety closure is provided with back-angled locking lugs respectively having a height which is less than the height of the closure.

It is still yet another object of the present invention to provide a safety closure for use on a container wherein the safety closure is provided with locking lugs having a shape which permits efficient molding thereof.

A safety closure according to the present invention includes a top wall, an annular side skirt depending downwardly from an outer periphery of the top wall and defining a lower end thereof opposite the top wall, an internal thread projecting inwardly from an inner annular surface of the side wall, the internal thread being disposed towards the top wall, and at least one lug projecting inwardly from the side wall inner annular surface, the at least one lug defining an acute angle with the side wall inner annular surface, the at least one lug having a substantially trapezoidal profile, the substantially trapezoidal profile having a base edge disposed parallel to a central axis of the side wall and coincident therewith, a lower edge projecting inwardly from a lower end of the base edge, an inner edge parallel to the base edge and extending upwardly from an innermost end of the lower edge, and an angled edge connecting an upper end of the inner edge with an upper end of the base edge, the base edge upper end being vertically above the inner edge upper end.

A better understanding of the present invention will be had upon reference to the following description in conjunction with the accompanying drawings in which like numerals refer to like parts, and wherein:

Figure 1 is a perspective view of a closure according to the preferred embodiment of the present invention shown with a neck portion of a container;

Figure 2 is a top view of the container of Figure 1;

Figure 3 is a bottom view of the closure of Figure 1;

Figure 4 is a section view of the closure of Figure 1 taken along section line 4-4 of Figure 3;

Figure 4a is a detailed section view of one element of the closure of Figure 1 taken along section 4a-4a of Figure 4;

Figure 5 is section view of the closure of Figure 1 taken along section line 5-5 of Figure 3;

Figure 6 is section view of the closure and container neck portion of Figure 1 taken along section line 5-5 of Figure 3;

Figure 7 is a section view of the closure and container neck portion of Figure 6 taken along section line 7-7 of Figure 6;

Figure 8 is a section view of a molding die typically used in the prior art;

Figure 9 is a section view of the molding die of Figure 8 taken along section line 9-9 of Figure 8;

Figure 10 is a bottom perspective view of a closure typical of the prior art molded in the molding die of Figure 8;

Figure 11 is a section view of the closure of Figure 10 taken along section line 11-11 of Figure 10;

Figure 12 is a section view of a molding die typically used to mold the closure of Figure 1; and,

Figure 13 is a perspective view of a closure according to another embodiment of the present invention shown with a neck portion of a container.

With combined reference to Figures 1 and 2, there is shown a closure 20 according to a preferred embodiment of the present invention in spaced relation to a container 10. The closure 20 is preferably constructed from flexible plastic material having resilience, such as, for example, polyethylene or polypropylene. The container 10 includes a body portion 11 (partially shown) and a neck portion 12 having an outer surface 13 thereof, an external thread 14 disposed towards an upper end 15 of the neck portion 12 and projecting outwardly therefrom and a pair of diametrically-opposed locking lugs 16, 17 disposed towards a lower end 18 thereof adjacent to the container body portion 11 and projecting outwardly therefrom. The locking lugs 16, 17 include respective sloped faces 16a, 17a and opposing abutment faces 16b, 17b.



With combined reference to Figures 1 and 3, the closure 20 includes a top wall 21 having an outer periphery and an annular side wall 22 depending downwardly therefrom and defining a lower end 28 thereof. The side wall 22 includes an inner surface 23, an internal thread 24 disposed towards an upper end 25 of the side wall 22 and projecting inwardly therefrom, and a pair of diametrically-opposed locking lugs 26, 27 disposed towards the lower end 28 thereof and projecting inwardly therefrom. The side wall 22 further includes an outer surface 29, which may have axial ribs, knurls or other similar texturing to enhance a user's grip thereon. The closure internal thread 24 is dimensioned to threadingly engage the external thread 14 of the container neck portion 12, thereby securing the closure 20 to the container 10. The closure locking lugs 26, 27 are dimensioned to matingly engage the respective container locking lugs 16, 17, thereby preventing rotation of the closure 20 relative to the container 10.

More particularly, the closure locking lugs 26, 27 project inwardly from the inner surface 23 of the side wall 22 along respective planes " $P_{26}$ ", " $P_{27}$ " respectively offset by an angle " $\alpha$ " from a plane "C" connecting respective points of intersection between the locking lugs 26, 27 and the side wall 22. The closure locking lugs 26, 27 respectively include angled front surfaces 26f, 27f and opposing angled rear surfaces 26r, 27r.

With additional reference to Figures 4 and 5, the closure locking lugs 26, 27 respectively include a substantially

trapezoidal profile having a base edge 26a, 27a integral with and coincident to the inner surface 23 of the side wall 22, an inner edge 26b, 27b parallel to and offset radially inwardly from the base edge 26a, 27a, a bottom edge 26c, 27c connecting  
5 respective lower distal ends of the base edge 26a, 27a and the inner edge 26b, 27b, and an angled edge 26d, 27d connecting respective upper distal ends of the base edge 26a, 27a and the inner edge 26b, 27b. The upper distal end of the respective base edge 26a, 27a is vertically above the upper distal end of  
10 the respective inner edge 26b, 27b such that the angled edge 26d, 27d being defined thereby slopes inwardly and downwardly from the inner surface 23 of the side wall 22.

With additional reference to Figure 4a, the locking lugs 26, 27 further include a trapezoidal cross-section, wherein  
15 the locking lugs 26, 27 have a thickness " $w_1$ " towards the angled edge 26d, 27d thereof which is greater than a thickness " $w_2$ " towards the bottom edge 26c, 27c thereof.

With reference to Figures 6 and 7, the closure 20 is threadingly affixed upon the container neck portion 12 so that  
20 the closure locking lug front faces 26f, 27f meet with and abut the respective container locking lug sloped faces 16a, 17a. Additional rotation of the closure 20 forces the closure locking lugs 26, 27 to flex radially outwardly along the respective sloped faces 16a, 17a until the closure locking lug  
25 inner edge 26b, 27b passes over and beyond an outermost edge 16c, 17c of the respective container locking lugs 16, 17, thereby interfering therewith and seating the closure locking lugs 26, 27 behind the respective container locking lugs 16,

17. Removal rotation of the closure 20 forces the closure locking lugs 26, 27 into deeper engagement with the respective container locking lugs 16, 17, thereby preventing removal of the closure 20 from the container neck portion 12.

5        Removal of the closure 20 from the container neck portion 12 requires a user to first overcome the interference between the closure locking lugs 26, 27 and the respective container locking lugs 16, 17. This is accomplished by applying opposed, inwardly-directed radial forces to an outer surface  
10    29 of the side wall 22 spaced equidistantly between the closure locking lugs 26, 27. The side wall outer surface 29 may include raised or flattened regions in an area surrounding the point of application of the inwardly-directed radial force. In response to the inwardly-directed radial forces,  
15    the side wall 22 is displaced radially inwardly in the area surrounding the point of application, forcing the side wall 22 to be displaced radially outwardly in a region surrounding the closure locking lugs 26, 27 a sufficient radial distance to permit the closure locking lug inner edge 26b, 27b to pass  
20    over the container locking lug outermost edge 16c, 17c. The so-called "squeeze efficiency" (i.e., the ratio of outwardly side wall radial displacement in relation to the amount of inwardly-directed radial force applied thereto) is increased due to the locking lugs' 26, 27 having a free angled edge 26d,  
25    27d, which permits a greater radial displacement in response to a lesser applied force. Removal rotation of the closure 20 is then applied to unthread the closure 20 from the container neck portion 12 and remove same therefrom.

Molding of the closure 20 is facilitated by the tapered, angled shape of the locking lugs 26, 27.

With combined reference to Figures 8-10, a molding die 100 typically used in the prior art to mold a prior art closure 180 having rectangular inwardly-projecting lugs 182, 184 includes an upper die segment 120 and a lower die segment 140, wherein cooperation of the upper die segment 120 with the lower die segment 140 defines an internal recess 160 having a shape conforming to the shape of the molded prior art closure 180.

More particularly, the lower die segment 140 includes a pair of lug-forming slots 142 having a substantially rectangular profile for forming the prior art locking lugs 182, 184. Typically, the lug-forming slots 142 include a constant thickness "t" and a depth "d" predetermined to provide optimal locking functionality.

Removal of the prior art closure 180 from the prior art molding die 100 is accomplished by first raising the upper die segment 120 in a direction indicated by reference numeral "M<sub>1</sub>", exposing an outer surface of the closure 180, and during which the molded closure 180 is held in place against the lower die segment 140 by the formed locking lugs 182, 184 being disposed within the lug-formed slots 142. Removal of the prior art closure 180 from the lower die segment 140 of the prior art molding die 100 requires the closure 180 to be forcibly pulled therefrom, oftentimes inducing significant flexural distortion and stress in the closure 180 and in the locking lugs 182, 184 as innermost regions 182a, 184a of the locking lugs 182, 184

interfere with and pass over outermost edge 142a of the lower die segment 140.

With combined reference to Figures 4 and 12, the tapered, angled shaped of the locking lugs 26, 27 facilitates removal of the closure 20 according to the present invention from a molding die 80 used to mold same.

The molding die 80 includes an upper die segment 82 being similar to the upper die segment 120 (Figure 8) used to mold a prior art closure 180, and a lower die segment 84, wherein cooperation of the upper die segment 82 with the lower die segment 84 defines an internal recess 86 having a shape conforming to the shape of the molded closure 20.

More particularly, the lower die segment 84 includes a pair of sloped lug-forming slots 90 having a substantially trapezoidal profile for forming the locking lugs 26, 27. Even more particularly, the lug-forming slots 90 include sloped faces 92 corresponding to the locking lug angled face 26d, 27d.

Removal of the closure 20 from the molding die 80 occurs by a process of substantially the same steps as heretofore described in removing the prior art closure 180 (Figure 10) from the prior art molding die 100 (Figure 8). Firstly, the upper die segment 82 is moved upwardly in a direction indicated by reference numeral "M<sub>2</sub>", thereby exposing an outer surface of the closure 20 and during which the molded closure 20 is held in place against the lower die segment 84 by the formed locking lugs 26, 27 being disposed within the lug-forming slots 90. Although removal of the molded closure 20

from the lower die segment 84 requires that the closure 20 be forcibly pulled therefrom, distortion of the locking lugs 26, 27 is reduced by the locking lugs inner edge 26b, 27b being guided over the respective lug-forming slot sloped faces 92.

5 Further, the tapered cross-section of the locking lugs 26, 27 enhances the ease with which the locking lugs 26, 27 slide from within the respective lug-forming slots 90.

With reference to Figure 13, a closure 120 according to another embodiment of the present invention includes a top  
10 wall 121 having an outer periphery and an annular side wall 122 depending downwardly therefrom and defining a lower end 128 thereof. The side wall 122 includes an inner surface 123, an internal thread 124 disposed towards an upper end 125 of the side wall 122 and projecting inwardly therefrom, and a  
15 pair of diametrically-opposed locking lugs 126, 127 disposed towards the lower end 128 thereof and projecting inwardly therefrom. The side wall 122 further includes an outer surface 129, which may have axial ribs, knurls or other similar texturing to enhance a user's grip thereon. The  
20 closure internal thread 124 is dimensioned to threadingly engage the external thread 14 of the container neck portion 12, thereby securing the closure 120 to the container 10. The closure locking lugs 126, 127 are dimensioned to matingly engage the respective container locking lugs 16, 17, thereby  
25 preventing rotation of the closure 120 relative to the container 10. The closure locking lugs 126, 127 respectively include a substantially triangular profile having a base edge 126a, 127a integral with and coincident to the inner surface

123 of the side wall 122, a bottom edge 126c, 127c projecting inwardly from a lower end of the base edge 126a, 127a, and an angled edge 126d, 127d connecting an inner end of the bottom edge 126c, 127c with an upper end of the base edge 126a, 127a.

5       The foregoing detailed description is given primarily for clearness and understanding and no unnecessary limitations are to be understood therefrom, for modifications thereto will become obvious to one skilled in the art upon reading this disclosure and may be made without departing from either the  
10       spirit or the scope of the present invention.

## CLAIMS

1. A closure, comprising:

a top wall;

5 an annular side wall depending downwardly from an outer periphery of said top wall and defining a lower end thereof opposite said top wall; and,

at least one lug projecting inwardly from said side wall inner annular surface, said at least one lug having a  
10 substantially trapezoidal profile, said substantially trapezoidal profile having a base edge coincident with said side wall inner annular surface, a lower edge projecting inwardly from a lower end of said base edge, an inner edge extending upwardly from an innermost end of said lower edge,  
15 and an angled edge connecting an upper end of said inner edge with an upper end of said base edge, said base edge upper end being vertically above said inner edge upper end.

2. The closure according to claim 1, wherein said at least  
20 one lug further includes:

an upper thickness towards said angled edge; and,

a lower thickness towards said lower edge, said upper thickness being greater than said lower thickness.

25 3. The closure according to claim 1, further comprising:

an internal thread projecting inwardly from an inner annular surface of said side wall, said internal thread being disposed towards said top wall.



4. The closure according to claim 3, wherein:

said base edge upper end is disposed vertically below  
said internal thread.

5 5. The closure according to claim 1, wherein:

said at least one lug is disposed substantially in a  
plane, said plane defining an acute angle with said side wall  
inner annular surface.

10 6. The closure according to claim 1, wherein:

said at least one lug base edge being disposed along an  
axis thereof parallel to a central axis of said side wall.

7. The closure according to claim 1, wherein:

15 said at least one lug inner edge being disposed along an  
axis thereof parallel to said base edge axis.

8. A closure, comprising:

a top wall;

20 an annular side wall depending downwardly from an outer  
periphery of said top wall and defining a lower end thereof  
opposite said top wall; and,

at least one lug projecting inwardly from said side wall  
inner annular surface, said at least one lug having a  
25 substantially triangular profile, said substantially  
triangular profile having a base edge coincident with said  
side wall inner annular surface, a lower edge projecting  
inwardly from a lower end of said base edge, and an angled

edge connecting an inner end of said lower edge with an upper end of said base edge.

9. The closure according to claim 8, wherein said at least  
5 one lug further includes:

an upper thickness towards said angled edge; and,  
a lower thickness towards said lower edge, said upper thickness being greater than said lower thickness.

10 10. The closure according to claim 8, further comprising:  
an internal thread projecting inwardly from an inner annular surface of said side wall, said internal thread being disposed towards said top wall.

15 11. The closure according to claim 10, wherein:  
said base edge upper end is disposed vertically below said internal thread.

12. The closure according to claim 8, wherein:  
20 said at least one lug is disposed substantially in a plane, said plane defining an acute angle with said side wall inner annular surface.

13. The closure according to claim 8, wherein:  
25 said at least one lug base edge being disposed along an axis thereof parallel to a central axis of said side wall.

14. The closure according to claim 8, wherein:

said at least one lug inner edge being disposed along an axis thereof parallel to said base edge axis.

15. A closure substantially as described herein with reference to Figures 1-7 and 12-13 of the accompanying drawings.



Application No: GB 9821615.3  
Claims searched: 1-7

Examiner: Michael Logan  
Date of search: 4 January 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:  
UK CI (Ed.Q): B8T (THN, THSB)  
Int CI (Ed.6): B65D 41/34, 50/04, 55/02  
Other: Online: WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
Y	EP 0787660 A1 (KUSZ) see back angled lugs 70a in figs 13-18	3-5
X, Y	EP 0343778 A1 (JOHNSON & JORGENSEN) see trapezoidal tab 6	X:1,6,7 Y:3-5
X	US 4545496 (WILDE) see trapezoidal tab 42	1,3-7
X	US 4410097 (KUSZ) see trapezoidal tab 25	1,6,7

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.